R E P O R T R E S U M E S

ED 020 193 24 TE 499 985

A STUDY TO EXPLORE THE POSSIBLE USES OF X-RAY MOTION PICTURE PHOTOGRAPHY FOR THE IMPROVEMENT OF BRASS INSTRUMENT TEACHING. SUMMARY REPORT.

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REPORT NUMBER BR-6-8322 PUB DATE 67
CONTRACT OEC-3-6-068322-0939
EDRS PRICE MF-$0.25 HC-$0.56 12P.

DESCRIPTORS- *MUSIC EDUCATION, *EDUCATIONAL RESEARCH, *BANDS (MUSIC), *RESEARCH METHODOLOGY, *PHOTOGRAPHY, RESEARCH TOOLS, EDUCATIONAL IMPROVEMENT, FILMS, MUSIC TECHNIQUES, INSTRUMENTATION, MUSIC, UNIVERSITY OF IOWA,

THE OBJECTIVE OF THIS STUDY WAS TO COLLECT INFORMATION WHICH WOULD LEAD TO MORE EFFICIENT TEACHING OF SUCH FUNDAMENTALS OF BRASS INSTRUMENT PERFORMANCE AS PITCH, DYNAMICS, AND ARTICULATION. FIVE FRENCH HORN AND FIVE TRUMPET PLAYERS WERE PHOTOGRAPHED BY MEANS OF CINEFLUOROGRAPHY DURING THE PERFORMANCE OF CERTAIN MUSICAL EXERCISES. REPRESENTATIVE FRAMES OF THE DEVELOPED FILM WERE PROJECTED ON TRACING PAPER FROM WHICH MEASUREMENTS OF VARIOUS ORAL ADJUSTMENTS WERE TAKEN AND SUBSEQUENTLY SUBJECTED TO STATISTICAL ANALYSIS. THE GENERAL CONCLUSIONS WERE--(1) THE MOST COMMONLY USED TONGUE AND PHARYNX POSITIONS FOR BOTH INSTRUMENTS ARE SIMILAR TO THE POSITION INTERMEDIATE BETWEEN THAT USED TO FORM THE VOWEL "AH" AND THAT USED FOR THE VOWEL "OO." (2) SEVERAL SUPRALARYNGEAL ADJUSTMENTS ARE RELATED TO CHANGES IN REGISTER. (3) NOTES WITHIN SLURRED INTERVALIC SEQUENCES ARE USUALLY BEGUN WITH A SLIGHT UPWARD AND FORWARD JERK OF THE TONGUE. (4) VOLUME MAKES NO IMPORTANT DIFFERENCE IN SUPRALARYNGEAL POSITIONS. (5) THE TONGUE REMAINS SLIGHTLY HIGHER AND FARTHER FORWARD DURING TONGUED NOTES THAN DURING SLURRED NOTES. (THE MUSICAL PASSAGES USED FOR THE STUDY AND A SAMPLE TRACING OF TONGUE AND PHARYNX POSITIONS ARE INCLUDED.) (JS)

BR-6-8322
PA-24

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SUMMARY

Title: A STUDY TO EXPLORE THE POSSIBLE USES OF X-RAY MOTION PICTURE PHOTOGRAPHY FOR THE IMPROVEMENT OF BRASS INSTRUMENT TEACHING

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Project Number: 68322

Duration: June 1, 1966 - February 28, 1967

TE 490 985

BACKGROUND

An understanding of tongue and throat adjustments during brass instrument performance is of considerable pedagogical importance to instrumental teachers, since these adjustments are basic elements in the successful production of such fundamentals as tone, articulation, intonation, and dynamic level. Although most teachers of brass instruments explain these processes on the basis of their own experience, their opinions concerning intra-oral changes vary greatly and players too frequently find it necessary to determine their particular solutions through trial and error.

Expert, yet frequently contradictory, opinions concerning tongue and throat adjustments which relate to various changes in articulation, dynamics, or pitch, have been expressed in numerous writings; however, scientific investigation designed to substantiate or disprove the theories so promulgated has been minimal. The chief reason for this scarcity of precise knowledge has probably been the lack of means of investigation, since prior to the recent developments in cinefluorography, the only means of investigation were still X-ray pictures, which were, or course, incapable of showing any transitory intra-oral adjustments.

OBJECTIVES

The present investigation of oral adjustments occurring during French horn and trumpet performance was primarily

motivated by the premise that more information on supralaryngeal adjustments will eventually result in more efficient and uniform pedagogical approaches to fundamentals of brass instrument performance such as pitch, dynamics, and articulation.

The use of cinefluorography will enable us to:

1. Photograph the oral cavity during the playing of selected performance tasks;
2. Note similarities and patterns in oral adjustments;
3. Relate the similarities to the performance tasks;
4. Draw substantiated conclusions concerning the use of the tongue and throat.

PROCEDURE

The ten subjects (five French horns, five trumpets) chosen for this study were either advanced music students or members of the brass faculty at the University of Iowa. Each was photographed during his performance of the tasks shown on the following pages. Representative frames (i.e., those related to the stated objectives) of the developed film were projected and traced on tracing paper. (A sample tracing is shown on page 8.) Measurements from arbitrarily determined points were then taken from the tracings; these measurement data were used to represent the given note in subsequent analyses and syntheses.

The data obtained were grouped and subjected to two- (A x S Designs) and three- (A x B x S Designs) dimensional

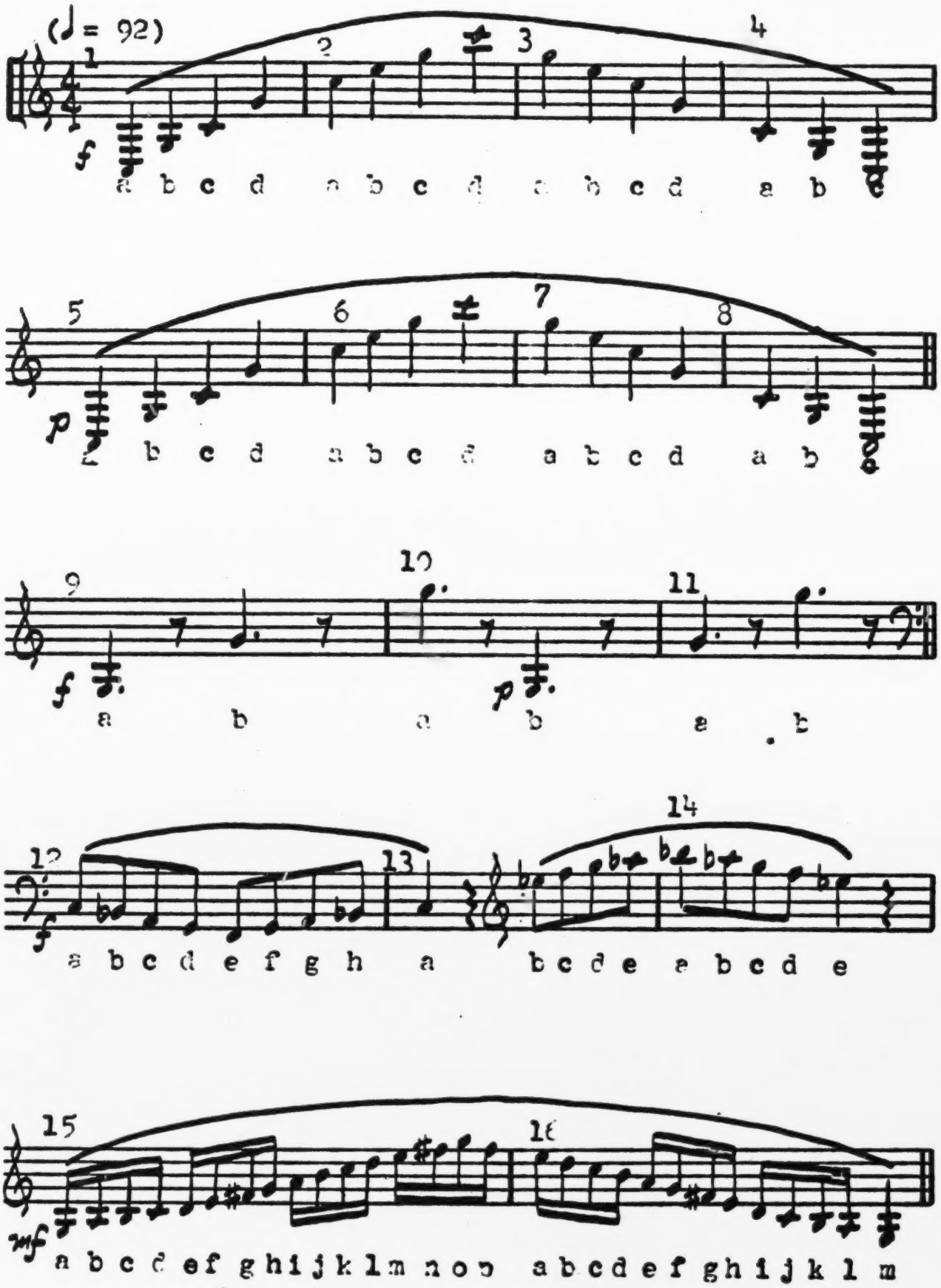
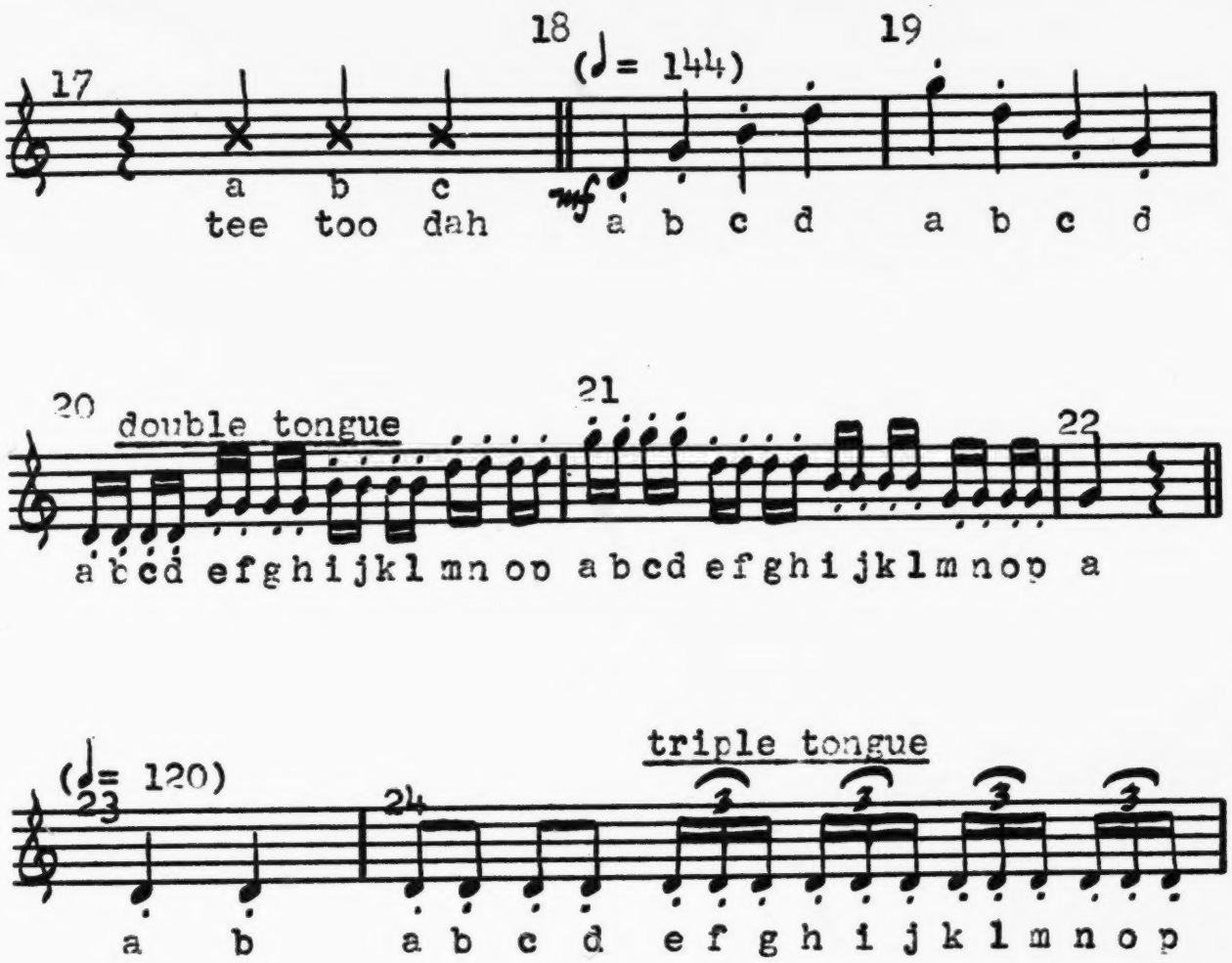



Figure 1. Performance task, French horn.


17
18
(♩= 144)
19
a b c
tee too dah
mf
a b c d
a b c d
20
double tongue
21
22
a b c d e f g h i j k l m n o p a b c d e f g h i j k l m n o p a
(♩= 120)
23
24
triple tongue
a b
a b c d e f g h i j k l m n o p
25
26
a b c d e f
a b c d e f g h i j k l m n
27
28
a b c d e f g h i j k l m n o p
a

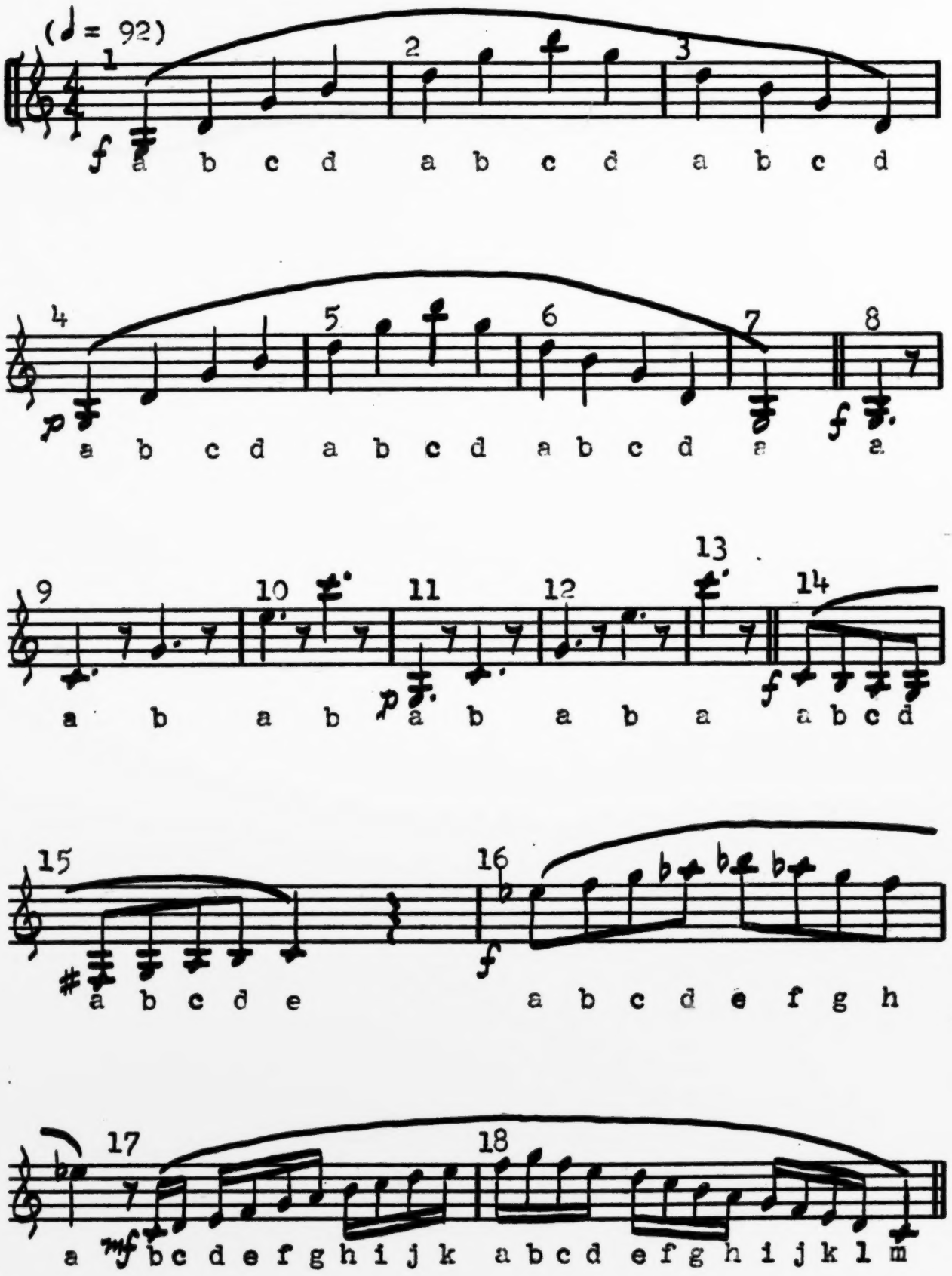
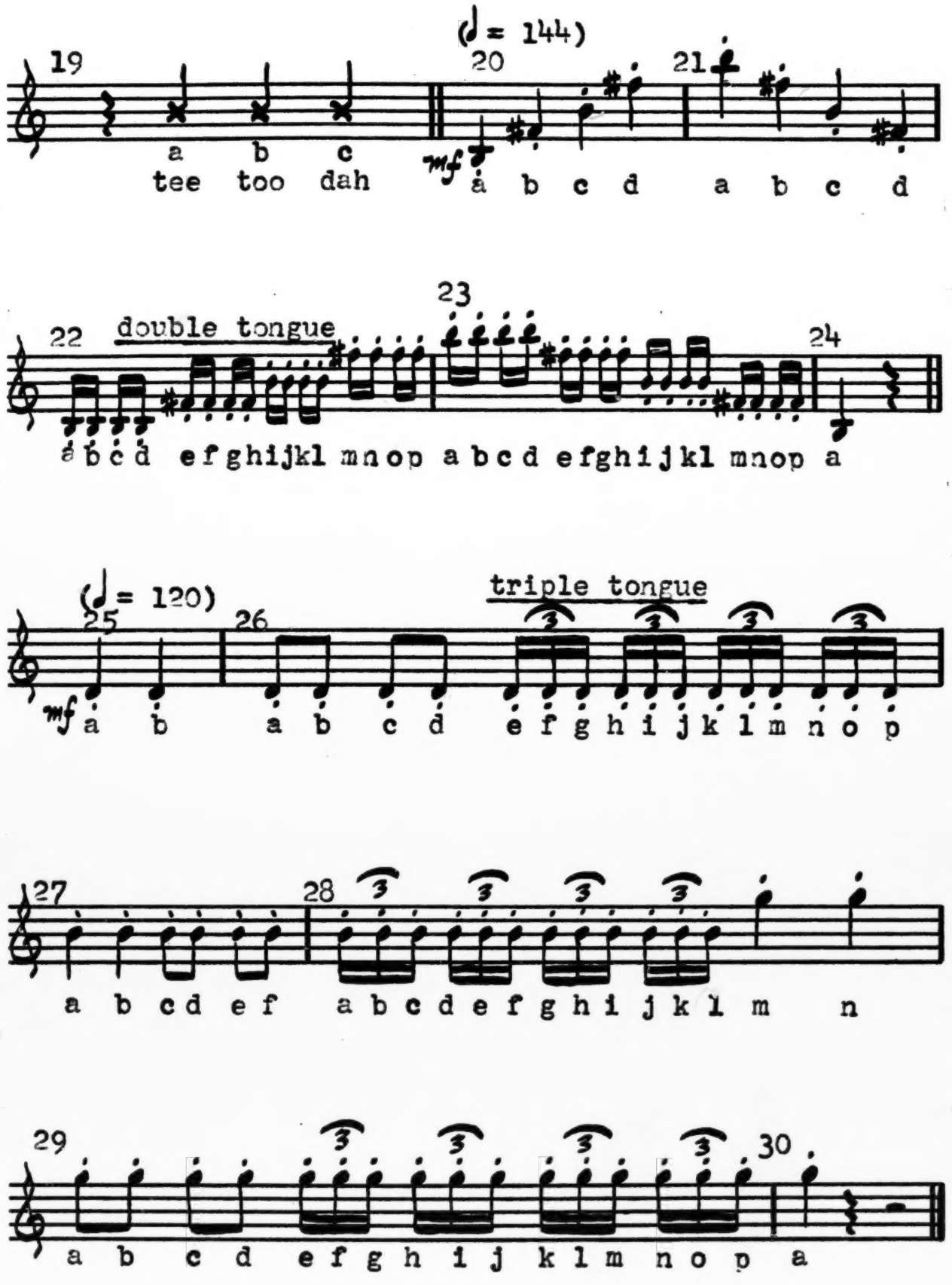
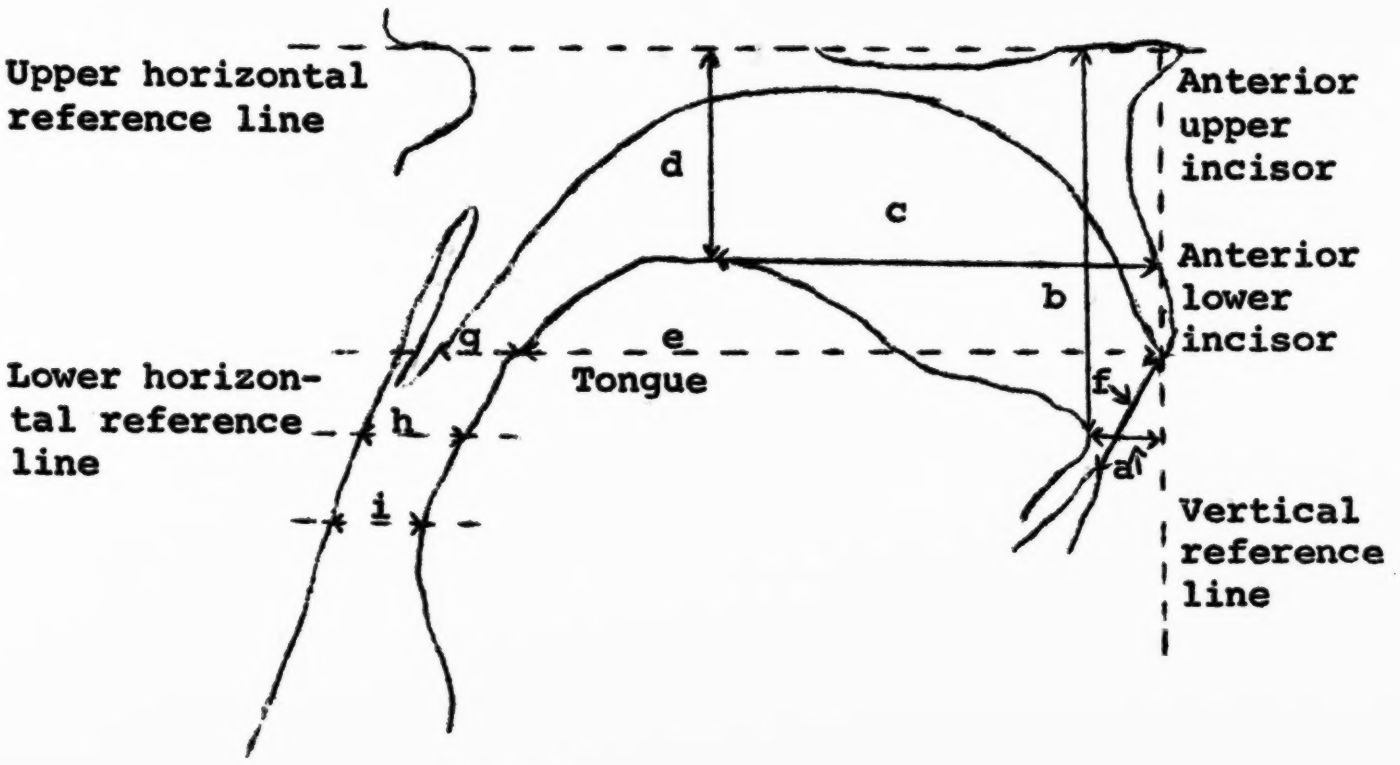


Figure 2. Performance task, trumpet.


(♩ = 144)
19
20
21
a b c
tee too dah
mf
a b c d a b c d
22
double tongue
23
24
a b c d e f g h i j k l m n o p a b c d e f g h i j k l m n o p a
(♩ = 120)
25
26
triple tongue
mf
a b a b c d e f g h i j k l m n o p
27
28
a b c d e f a b c d e f g h i j k l m n
29
30
a b c d e f g h i j k l m n o p a



Upper horizontal reference line: From the first cervical vertebra through the anterior nasal spine.
Vertical reference line: Right angle to upper reference line through tip of anterior upper incisor.
Lower horizontal reference line: Parallel to upper horizontal reference line through tip of anterior upper incisor.

Measurements:

a. Anterior tongue (horizontal dimension)
b. Anterior tongue (vertical dimension)
c. Tongue high point (horizontal dimension)
d. Tongue high point (vertical dimension)
e. Posterior tongue (horizontal dimension)
f. Incisal opening
g. Pharynx opening at lower horizontal reference line
h. Pharynx opening one cm. below lower horizontal reference line
i. Pharynx opening two cm. below lower horizontal reference line

Figure 3. Sample tracing showing reference lines and dimensions measured.

statistical analyses to determine measurement relationships within and among groups.

RESULTS

1. Slurring Ascending and Descending Passages.

Six performers moved the tongue upward and forward for higher pitched notes and downward and backward for lower notes, as in singing the vowel sounds "ah," "oo," and "ee" in that order. Four performers showed relatively little supralaryngeal variation during the playing of the ascending and descending passages.

Four French horn subjects raised the lower jaw for higher pitched notes.

The pharyngeal dimensions of the French horn subjects tended to be smaller for higher pitched notes than for lower ones. The reverse was true for the trumpet subjects.

2. Playing in the "Extreme" Registers.

Essentially the same relationships between changes in pitch and supralaryngeal adjustments were apparent in the data derived from the "extreme" range group of notes as were discerned in the corresponding data from the slurred ascending and descending passages.

3. Producing a Particular Pitch Under Diverse Conditions

The same adjustments noted above were true for between-pitch comparisons in note groups containing two or three pitches

repeated under varying conditions. The pharyngeal apertures of the French horn performers tended to be larger for the tongued notes.

4. Attacking Notes in Different Registers at Varying Dynamic Levels.

No relationship was found between tongue position before the attack and the register of the tone produced after the attack. Data from the trumpet subjects indicated that both before and after the attack their incisal and pharyngeal apertures were smaller for higher pitches.

5. Single-, Double-, and Triple-Tonguing on Various Pitches

Pitch-related oral adjustments were not discernible for double- and triple-tongued notes. The previously indicated pharyngeal pattern with smaller openings for higher notes still held true for the French horn subjects.

When the posterior tongue does not completely close against the roof of the mouth, the sound of a clean, crisp attack is lost, although the effect of double- and triple-tonguing remains.

6. Forte Versus Piano Conditions.

For trumpet subjects the tongue high point was farther forward for notes of the arpeggio played piano than for corresponding notes of the forte arpeggio.

7. Ascending Versus Descending Conditions.

Trumpet subjects used a smaller upper pharyngeal aperture for descending notes than for corresponding ascending notes.

CONCLUSIONS

1. Although trumpet and French horn players tend to assume individual intra-oral positions, the most commonly employed positions for both instruments are similar to vowel positions intermediate between an "ah" and an "oo" formation.

2. Several patterns of supralaryngeal adjustment related to register change take place in playing both French horn and trumpet. Some subjects move the tongue upward and forward for higher pitches, while others do not. French horn subjects usually tend to raise the lower jaw for higher pitches, thereby decreasing the size of the incisal aperture; no such incisal variation was apparent for trumpet subjects. Pharyngeal dimensions for French horn subjects tend to be smaller for higher pitched notes; the reverse is true for trumpet subjects.

3. Notes within slurred intervalic sequences are usually begun with a slight upward and forward jerk of the tongue.

4. Essentially the same supralaryngeal positions are used for corresponding pitches played <u>forte</u> and <u>piano</u>. Similar absence of variation is apparent when corresponding notes from ascending and descending passages are compared.

5. The tongue tends to remain slightly higher and farther forward during tongued notes than it does during corresponding slurred notes.

BIBLIOGRAPHY

There are 26 references listed in the final report.